# *Stackhousia stratfordii* (Celastraceae: Stackhousioideae), a remarkable new species from a remote location near Norseman, south-west Western Australia

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## Abstract

Barker W.R. & Cockerton G.T.B. *Stackhousia stratfordii* (Celastraceae: Stackhousioideae), a remarkable new species from a remote location near Norseman, south-west Western Australia. *Nuytsia* 21(2): 69–74 (2011). *Stackhousia stratfordii* W.R.Barker & Cockerton *sp. nov.* possesses attributes unique to its genus and subfamily of opposite sub-radical leaves and flowers borne in scapes and containing three stamens. Morphological evidence is summarised arguing its placement within *Stackhousia*.

## Introduction

The Stackhousioideae Burnett are a subfamily distinctive in Celastraceae R.Br. for their herbaceous life-form, mainly moth-pollinated, tubular flowers, and fruits that are single-seeded indehiscent mericarps (cocci) (Barker 1983, 1984, in press); in terms of diversity they are centred in Australia, occurring in much of the continent, in temperate, arid, semi-arid and sub-tropical regions. Until recently a separate family (Stackhousiaceae R.Br.), the subfamily has morphological and geographic features unique in the family Celastraceae, in which they have been placed in the last decade (Kubitzki 2004a, b; Simmons 2004 a, b). It comprises three genera: *Tripterococcus* Endl. with three species, confined to south-west Western Australia, *Macgregoria* F.Muell., a single species spread across the southern half of arid Australia, and *Stackhousia* Sm. with over 30 species spread over the geographical and climatic range of the subfamily in Australia, with a single species in New Zealand and another spread into Malesia, the Philippines and Micronesia (Barker, in press).

Several species, groups of species and the two smaller genera in the Stackhousioideae have unusual features, most notably *Tripterococcus* with its cocci that detach by the acropetal splitting of the gynophore and *Macgregoria* with its free petals, appendaged anthers, style encircled by a membranous cup and hooked eglandular hairs on the cocci. Within *Stackhousia* there are other morphological rarities (see e.g. Barker, in press), including the following: blue flowers in *S. tryonii* F.M.Bailey in eastern Queensland; umbelliform inflorescences in *S. umbellata* C.A.Gardner & A.S.George from a coastal arid range in north-west Western Australia; the very long style in *S. dielsii* Pamp. in south-west Western

Australia; winged cocci in *S. megaloptera* F.Muell. of the arid-zone sand dunes and *S. spathulata* Sieber ex Spreng. of coastal sands and calcrete pavements in south-eastern and eastern Australia (likely a plesiomorphic state shared with *Tripterococcus*); and solitary flowers in the subalpine *S. pulvinaris* F.Muell. in Australia and *S. minima* Hook.f. in New Zealand.

*Stackhousia stratfordii* W.R.Barker & Cockerton *sp. nov.*, described herein as new, similarly has unusual features. It is known only from the type collection and associated photographs from the type population. Unique in the subfamily are its opposite leaves clustered at ground level, its inflorescences borne on scapes, and its flowers with three stamens. The opposite arrangement of leaves is evident from the tightly packed branches in the limited material available, but should be confirmed in a wider sample of plants.

## Relationships and generic placement

Before the advent of cladistics and the concept of monophyly (Hennig 1966), this species would have been described in a remarkable new genus, so great are its differences from other genera in the Stackhousioideae. However, the most striking of these are unique to this species and hence are uninformative as to its relationships; shared derived character states (synapomorphies) are required to ascertain the phylogenetic placement of taxa.

The new species has a widely spread, herbaceous fruiting hypanthium and a short style, and its cocci are attached near their base to the gynophore; these are derived character states that are not shared by all species in the genus. As a result, on current evidence these features place it firmly within *Stackhousia*. Morphological features are dealt with further in a taxonomic review of the subfamily (Barker in press) and will be described in more detail in a paper on phylogeny and classification within the subfamily based on current morphological and molecular studies (W.R. Barker & D.O. Burge, in preparation). A preliminary phylogeny of the subfamily based on molecular analysis appears in Burge & Barker's (2010) paper on the origins of high levels of nickel uptake in the Queensland species *S. tryonii* F.M.Bailey. Material from specimens of *S. stratfordii* is being analysed for nickel content.

Several species of *Stackhousia* have apparently plesiomorphic (ancestral) character states (shared with *Tripterococcus*, which recent molecular studies indicate is sister to a clade comprising *Stackhousia* and *Macgregoria*: Zhang & Simmons 2006; Simmons *et al.* 2008). For example, *Stackhousia georgei* Diels shares with *Tripterococcus* an elongated zone of coccus attachment almost as long as the cocci; this may be homologous with the axis of the capsules in related genera of Celastraceae (Zhang & Simmons 2006; Simmons *et al.* 2008; Simmons 2004a) which runs their full length. *S. dielsii* possesses a very long gynophore with a very long style, which may be homologous with the long gynophore of *Tripterococcus* and long axis of the capsules of *Peripterygia*. It also shares with two unnamed species of *Tripterococcus* (Barker, in press) a hard, thick, cup-shaped fruiting hypanthium with the cocci supported above it; *T. brunonis* Endl. is slightly divergent in this feature. Two other species in *Stackhousia, S. sp. Swollen gynophore (W.R. Barker 2041)* (being given a formal name by Barker, in press) and *S. occidentalis* Domin, have cocci borne above the hypanthium, though the hypanthium remains more obviously membranous in fruit like other *Stackhousia* species and is filled with a cartilaginous core. *S. spathulata* and *S. megaloptera* possess winged cocci, apparently homologous with the winged cocci of *Tripterococcus* and the narrow wing-like carpels of the capsular fruits of *Peripterygia*. Accordingly, on this best available evidence, all these species possess character states that are apparently plesiomorphic in *Stackhousia*, and are likely to be early-derived species. That these

apparently plesiomorphic character states (present in both *Tripterococcus* and *Stackhousia*) are not represented in our new species points to placing it within *Stackhousia*; it has presumably speciated later in the diversification of *Stackhousia* than the other species or their ancestors in the genus with these plesiomorphic states.

## Taxonomy

For a generic description and key to species of *Stackhousia*, adjusted to account for this new species, see Barker (in press), which deals also with the taxonomy of the Stackhousioideae. Further molecular and morphological work is being undertaken to produce a whole-evidence based phylogeny of the subfamily and infrageneric classification of *Stackhousia* (W.R. Barker & D.O. Burge, in preparation). A preliminary molecular study is incorporated in a study of the origins of nickel uptake in the Queensland species *S. tryonii* F.M.Bailey (Burge & Barker 2010).

**Stackhousia stratfordii** W.R.Barker & Cockerton, *sp. nov.*

A speciebus totis *Stackhousiae* Sm. a foliis rosulatis, oppositis, inflorescentibus scapis, et staminibus tribus differt.

*Typus*: 50 km west of Norseman, Western Australia, 8 October 2009, *G. Cockerton* LCH 26184 (*holo*: PERTH 07702868; *iso*: AD 243532).

*Annual herb* to 12 cm high with a cluster of 5–20 or more branches arising from the rootstock. *Leaves* confined to the very base of the branches in a loose rosette, those observable opposite, spathulate to narrow obovate, 30–60 mm long, 4–8 mm wide, flat, pale to mid green, glabrous, more or less fleshy *in vivo*, with a midvein apparent on the underside; basal pairs of leaves much shorter, broadly spathulate to obovate. *Flowers* 20 or more, in tight clusters in flower, spaced by fruiting stage, arranged singly in spiciform racemes terminating scapes *c.* 80–150 mm long emergent well above the leaves, the peduncle *c.* 65–130 mm long; bracts and bracteoles green with a broad white margin, erose to erosulate, glabrous; bracts ovate, (0.6–)0.8–1.2 mm long, the lowest up to 2.0 mm long; bracteoles 2, opposite, borne at the base of the pedicel, narrow ovate, 0.4–0.5 mm long; pedicels 0.1–0.2 mm long, lengthening to 0.3 mm long in fruit. *Hypanthium* cup-shaped, *c.* 0.5 mm long, 0.8–1.0 mm broad at apex, green, glabrous. *Sepals* ovate, 1.0–1.1 mm long, *c.* 0.5 mm broad, green, sometimes reddened towards apex, broadly acute to obtuse, with broadish white margin, erosulate towards the apex, glabrous. *Corolla* white, with tube 1.8–2.0 mm long, *c.* 0.6 mm broad; lobes flat, spreading at right angles to slightly reflexed, ovate to elliptic-ovate, (1.5–)1.8–2.1(–2.3) mm long, 0.9–1.4 mm broad, obtuse. *Stamens* 3, equal in length; anthers 0.6–0.7 mm long. *Ovary* 3-carpellate. *Cocci* 3, attached at very base to the gynophore, borne within the spreading, slightly accrescent, membranous fruiting hypanthium, broadly obovoid-obloid, 1.5–1.7 mm long, 1.3–1.4 mm broad, indistinctly rugose-reticulate, eglandular-asperate, light green to light brown; scar around point of attachment to the gynophore triangular, *c.* 0.5 mm long, 0.2 mm wide, convex, lacking a cartilaginous swelling; gynophore slightly swollen with cartilaginous tissue surrounding the short basal stalk and points of attachment of the cocci, with style much shorter than the coccus length and as long as the stigmas. (Figure 1)

*Phenology.* From available knowledge known to flower and fruit in October (type collection) and November with buds known in late August indicating that it flowers at least as early as September.

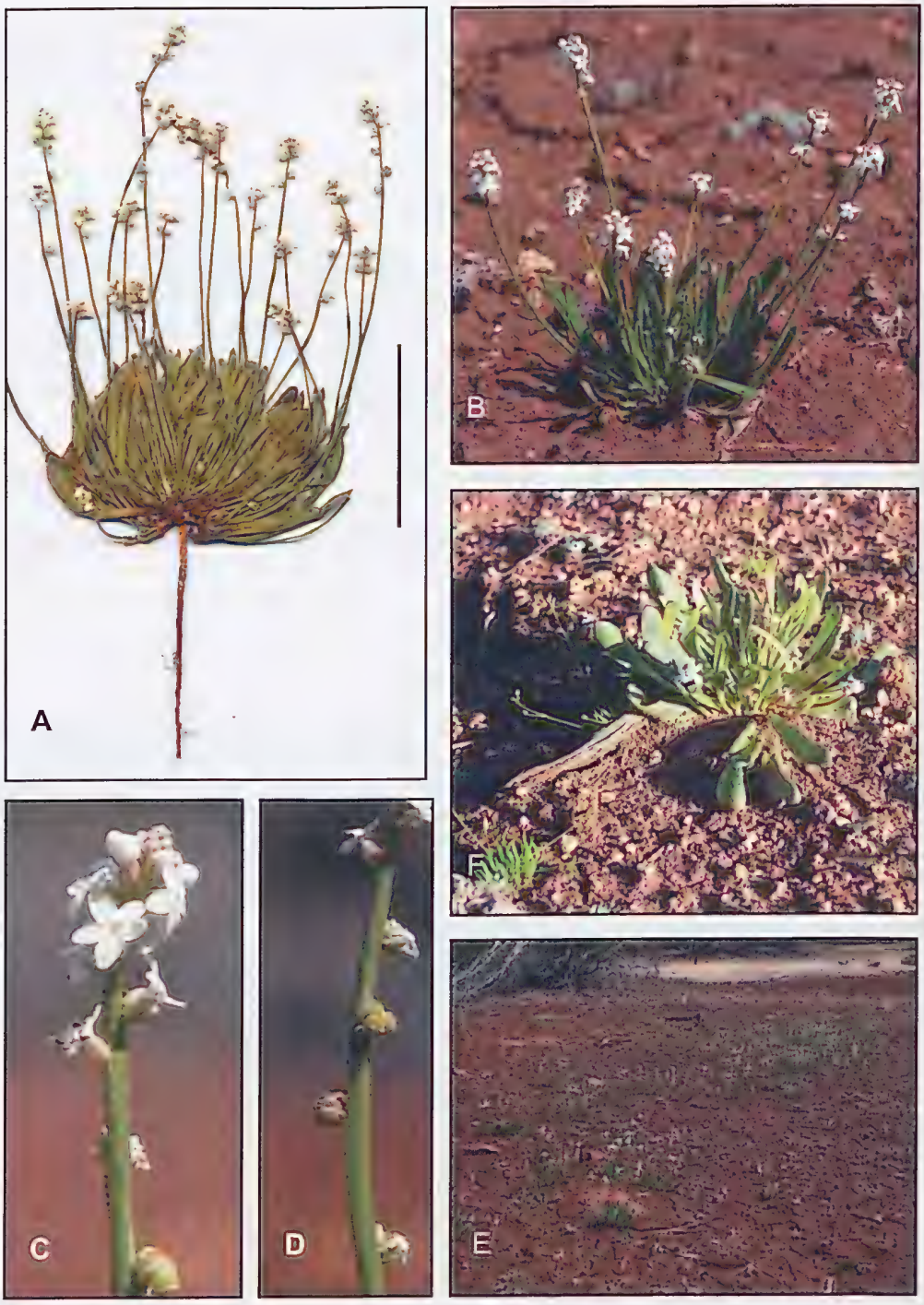


Figure 1. *Stackhousia stratfordii*, type population. A – from visit on 8th October 2009, scanned image of herbarium specimen (*G. Cockerton* LCH 26184), scale bar = 5 cm; B – E. Visit on 8th October 2009. B – whole plant; C – D – inflorescence with buds, flowers and fruits; E – population on smectite clay. F. Visit on 27th August 2003, young plant with flowering stems beginning to elongate. Photographs by G. Cockerton .

*Distribution.* Known only from the type locality approximately 50 km west of Norseman, Western Australia in the Coolgardie IBRA region, which comprises semiarid woodland and shrubland communities.

*Habitat.* At the type locality this species is restricted to a well-defined, boggy depression, estimated to be 1000 sq m in area, of dark brown smectite clay soil, on the crest of a ridge (Figures 1B, E). Soil is a friable self mulching yellowish-red clay. In 1997 80% of the ground was bare and a thick layer of leaf litter was restricted to under trees. Associated vegetation includes *Eucalyptus trichopoda*, *Eucalyptus calycogona* ssp. *calycogona* (dominant) and *Eucalyptus melanoxylon* woodland 4–7 m high, with a scattered shrub understorey of *Exocarpos aphyllus*, *Eremophila ionantha*, *Santalum acuminatum*, *Alyxia buxifolia*, *Grevillea acuaria* and *Eremophila dempsteri*. Other herbs present with the new species included species of Asteraceae, *Ptilotus aervoides, Ptilotus carlsonii, Hydrocotyle* sp. and *Goodenia* sp.

This small, specialised and confined habitat is surrounded by dark red sandy loams supporting *Eucalyptus griffithsii* woodlands with a *Triodia scariosa* understorey.

*Conservation status.* Given its very restricted known distribution, *Stackhousia stratfordii* has recently been listed as Priority One under the Department of Environment and Conservation (DEC) Conservation Codes for Western Australia Flora.

*Etymology.* Named in recognition of Ms Kirsty Stratford's major contribution to the botany of the Western Goldfields over many years. She and the second author discovered the species in 1997 and photographed it in 2003 when they brought it to the attention of the Western Australian Herbarium and the senior author.

*Notes.* The site is traversed by a grid line constructed for mining exploration prior to 1997, with the majority of the surrounding area undisturbed. There is no evidence of recent fires. At that time of its discovery it was suggested that the presence of the few plants of this geosporous species sighted were a response to disturbance caused by track construction activities. Observations in 2009, in the absence of any disturbance to the site in intervening years, indicate that the species is an annual responding to seasonal rainfall and is unlikely to be reliant on disturbance.

The first specimen of this new species was collected in 1997 (*G. Cockerton & K. Stratford* LCS 3685); however, despite a recent check it remains misplaced in the Western Australian Herbarium (Ms Karina Knight, pers. comm.). A duplicate in the Anaconda Nickel Ltd Reference Herbarium, also has been misplaced along with the whole herbarium (Andrew Clayton, pers. comm.). No collections were made in a visit in August 2003 as plants were immature.

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